Understanding Soil Functions

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BOOK OF ABSTRACTS

mycorrhizal colonization of plants. Identification of the functional traits of mycorrhizal fungi sensitive to walnut trees is required to inform decisions in specific agricultural practices.

Amy Thomas, Bernard Cosby, Emmett Bridget and Pete Henrys

Competing drivers of Soil Carbon change at a national scale

Soils are large temporary stores of carbon; losses may exacerbate climate change, whilst sequestration could provide mitigation. Projected changes in soil organic carbon (SOC) focus on climate and land use as drivers, however atmospheric deposition and modulating effects of geology may also be important. Here we explore potential drivers of SOC change using data from Countryside Survey (CS), a national long term survey of soils and vegetation. Past studies have identified habitat level trends related to management practices.
We construct models to explore variation in topsoil SOC concentration across CS sites using explanatory variables with known importance for SOC, including pH, geology, atmospheric deposition, climate and land use. Land use change was very important at sites where it occurred.
Models for the remaining sites suggest that pH and land use are the most important predictors of SOC. We were also able to detect relationships with climate variables and atmospheric deposition, and nonlinearities and thresholds in the influence of variables. Differences between models for different time periods enable us to interpret change in influence of drivers over time. For example, pH was more important in acid soils, with the threshold shifting from 4.8 (1978) to 5.5 (2007). This shift in the pH/SOC relationship, may either reflect a decadal lag in SOC response to pH change, or permanent disruption of this relationship by other drivers. This work will help inform development of new process-based modelling approaches. Appropriately structured ongoing monitoring is crucial, to inform parameterisation of these models and to detect trends.

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Biofunctool®: a new set of indicator to assess the impact of land management on soil functioning

The concept and methods to assess soil quality have been widely debated in the literature for the last twenty years. We developed a new framework to assess soil quality following an integrative approach based on the measurement of soil dynamic functions rather than stocks, namely Biofunctool®. Biofunctool® accounts for the interactions between soil physico-chemical properties and soil biological activity. It consists of twelve in-field, time- and cost- effective indicators to assess three main soil functions: carbon transformation, nutrient cycling and structure maintenance. Firstly, the capacity of Biofunctool® to assess the impact of land management on soil quality was validated through a reliability, redundancy and sensitivity analysis. The results over 250 sampling points in Thailand showed the relevance of each of the twelve indicators to assess soil functioning. Secondly, we applied Biofunctool® and aggregated the indicators in a Soil Quality Index that synthetize the impact of land management on soil quality. Biofunctool® was applied within various contexts (tree plantations, agroforestry, conservation agriculture etc.) and two cases study will be presented: i.) impacts of a disturbance gradient based on various land uses and rubber tree stands in Thailand ii.) impacts of conservation agriculture practices in Cambodia. The overall results proved that Biofunctool® index provides a synthetic soil functioning score that is sensitive to land management and is robust in various pedo-climatic contexts. Therefore, Biofunctool® is a reliable tool to assess the soil integrated functioning, i.e., soil quality, and could be included within larger environmental impact assessment frameworks.

Hao Tian, Zhitao Gao and Yandong Zhao

Study on Influence and Compensation Method of Soil Compactness on Soil Volumetric Water Content Measurement

Volumetric water content measurement based on soil dielectric properties is affected by soil tightness. The main commercial products currently in common use basically do not consider the influence of soil tightness on the measurement results that has larger measurement error. So on the basis of the principle of standing wave, this paper designed a portable soil volumetric moisture content sensor based on the principle of standing wave rate and the soil compactness is measured simultaneously. The coupling relationship between soil compactness and soil volumetric moisture content can be observed more easily by innovatively converting them into polar coordinates, and a modified soil volumetric moisture content model based on the soil compactness that was established.
